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FILE 'MEDLINE, EMBASE, SCISEARCH, BIOSIS' ENTERED AT 21:19:52 ON 30 JUN 2002

L1 700 S MULTIVARIANT ANALYSIS
L2 24 S L1 AND (MYOCAR?)
L3 12 DUP REM L2 (12 DUPLICATES REMOVED)
L4 0 S L1 AND (MYOGLOBIN AND TROPONIN AND CREATINE)
L5 0 S L1 AND (TROPONIN AND CREATINE)
L6 0 S L1 AND (TROPONIN)
L7 0 S L1 AND (CREATINE)
L8 2 S L1 AND (MYOGLOBIN)
L9 17 S L1 AND (MYOCARDIAL INFARCT?)
L10 8 DUP REM L9 (9 DUPLICATES REMOVED)

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L3 ANSWER 5 OF 12 MEDLINE DUPLICATE 3
ACCESSION NUMBER: 96219422 MEDLINE
DOCUMENT NUMBER: 96219422 PubMed ID: 8637276
TITLE: [Risk factors in stable coronary disease. Relationship with ischemic threshold and prognostic implications]. Factores de riesgo en la enfermedad coronaria estable. Su relacion con el umbral de isquemia e implicaciones pronosticas.
AUTHOR: Salcedo A; Echevarria P; Molinero E; Sagastagoitia D; Aguirre J M; Iriarte M M; Laka Mugarza J P
CORPORATE SOURCE: Seccion de Cardiologia Hospital de Galdakao, Vizcaya.
SOURCE: MEDICINA CLINICA, (1996 Mar 16) 106 (10) 372-7. Journal code: 0376377. ISSN: 0025-7753.
PUB. COUNTRY: Spain
Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: Spanish
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199607
ENTRY DATE: Entered STN: 19960719
Last Updated on STN: 19960719
Entered Medline: 19960710

AB BACKGROUND: To assess the clinical evolution, in a 5-year follow-up, of the development of acute coronary syndromes, in patients with angina clinically stable, establishing its relationship with the ischemic threshold (IT) and the main modifiable cardiovascular risk factors. PATIENTS AND METHODS: 120 patients, 86 males (71%), with an age of 57 +/- 8 years, with stable angina. The presence of smoking, hypercholesterolemia, hypertension and diabetes mellitus was evaluated. We performed exercise testings (baseline and after vasodilator drugs) in the beginning, in order to characterize the IT (which was fixed in 72 patients and variable in 48). The later group underwent exercise testing each term during the first year of follow-up. Lesion at least of 70% in a main coronary vessel was required as inclusion criteria. The development of acute **myocardial** infarction (AMI), unstable angina pectoris and cardiac death was recorded. Cox's hazard function analysis and **multivariant analysis** were applied. RESULTS: 106 patients (88%) had one or more risk factors (40% hypertension, 43% hypercholesterolemia, 22% diabetes mellitus and 56% were smokers or ex-smokers). A significant association was shown between male gender and smoking and diabetes mellitus and female gender. 6 cardiac deaths, 8 AMI and 9 unstable angina were recorded. Within the 72 patients with fixed IT, 12.5% (9) suffered some acute syndrome. In the 48 with variable IT, in the 30 who continued in it, 20% (6) developed acute coronary pathology and in the 18 who modified their IT to fixed, the prevalence was 44.5% (8). Patients with modification of IT to fixed had a higher risk of acute coronary syndrome in the follow-up ($p < 0.01$) and the presence of hypertension and hypercholesterolemia allowed the prediction of modification of the IT. CONCLUSIONS: The prevalence of cardiovascular risk factors in the stable coronary artery disease is high (88%); male gender is associated smoking and female gender to diabetes mellitus. The presence of hypertension and hypercholesterolemia are associated to modification in the IT in patients with variable threshold, allowing the detection of a subgroup of high risk for the development of acute coronary pathology.

L3 ANSWER 12 OF 12 MEDLINE
ACCESSION NUMBER: 65098145 MEDLINE
DOCUMENT NUMBER: 65098145
TITLE: **MULTIVARIANT ANALYSIS** OF CLINICAL AND PROGNOSTIC FACTORS IN **MYOCARDIAL** INFARCTION.
AUTHOR: LEMLICH A
SOURCE: NEW YORK STATE JOURNAL OF MEDICINE, (1965 MAY 15) 65 1209-15.
ISSN: 0028-7628.
PUB. COUNTRY: United States
Journal
LANGUAGE: English
FILE SEGMENT: OLDMEDLINE
ENTRY MONTH: 196508
ENTRY DATE: Entered STN: 19990716
Last Updated on STN: 19990716
TI **MULTIVARIANT ANALYSIS** OF CLINICAL AND PROGNOSTIC FACTORS IN **MYOCARDIAL** INFARCTION.
ST automatic data processing; **myocardial** infarct; prognosis

=>

STIC-ILL 1641 4/02,015 10 7/1

From: Gabel, Gailene
Sent: Sunday, June 30, 2002 9:33 PM
To: STIC-ILL
Subject: 09/839,778

Please provide a copy of the following literature:

1) Salcedo A; Risk factors in stable coronary disease. Relationship with ischemic threshold and prognostic implications. MEDICINA CLINICA, (1996 Mar 16) 106 (10) 372-7.

2) LEMLICH A, MULTIVARIANT ANALYSIS OF CLINICAL AND PROGNOSTIC FACTORS IN MYOCARDIAL INFARCTION. NEW YORK STATE JOURNAL OF MEDICINE, (1965 MAY 15) 65: 1209-15.

Thanks a bunch,
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Scientific Articles

Multivariant Analysis of Clinical and Prognostic Factors in Myocardial Infarction

A COMPUTER-SUPPORTED *study of the natural history and prognosis of myocardial infarction in 368 patients was carried out. Clinical shock was found to be the most important factor in the prognosis of the disease; other clinical factors carrying a grave prognosis are history of previous myocardial infarctions, advanced age, duration of temperature elevation, failure of the left side of the heart, and tachycardia. There was no great difference in survival between males and females at any age level. Further studies concerning the application of computer systems and technics to clinical heart disease are in progress.*

ARTHUR LEMLICH, M.D.
New York City

From the Department of Medicine, Roosevelt Hospital

HIGH-SPEED ELECTRONIC data-processing systems have greatly facilitated the collection and processing of scientific data. Application of computer technics have permitted major advances on a wide scientific front, ranging from astronomy to the study of protein structure. Adaptation of computer methods to medicine already has produced useful results, especially in the analysis of the electrocardiogram,[1] the electroencephalogram,[2] and other physiologic data.[3] These favorable results and the availability of a computer system in our hospital encouraged us to undertake the study described in this report.

Methods

CRITERIA FOR INCLUSION IN STUDY. This study concerned the natural history and the prognostic factors in myocardial infarction, the single most important clinical entity in North America and Europe. The data were taken from the hospital charts of all patients with acute myocardial infarction who were admitted to the Roosevelt Hospital during the calendar years 1958 and 1959. This diagnosis was supported by one or more of the following: autopsy findings, diagnostic electrocardiographic patterns, and typical clinical history and hospital course, including supportive laboratory data. Included in the study were 368 cases that met these criteria.

FACTORS EVALUATED. We next considered the selection of those factors that would be collected and evaluated in the study. Since we hoped to study the natural history of this disease, as well as to answer specific clinical questions, a broad information base was required. Factors representing both objective and subjective data were considered, as both are used in the clinical evaluation of the patient. Categories such as sex and age represent data that are easily handled. Categories such as pain, premonitory symptoms, and quality of heart sounds represent subjective data that are difficult to evaluate. During this study we hoped to improve our methods of evaluating such subjective data.

In all, we selected 68 factors for initial consideration (Table I). It was then necessary to subdivide each factor into appropriate subdivisions. Thus, "sex" was divided into "male" and "female"; and "occupation" into "sedentary," "moder-

TABLE I. Factors initially selected for study

- Characteristics of patient
  - Sex
  - Age
  - Occupation
  - Ward or private care
  - Availability of history
  - Smoking habits
  - Body weight
- Past medical history
  - Previous myocardial infarctions
  - Diabetes and diabetic control
  - Pulmonary disease
  - Vascular central nervous system disease
  - Arterial and venous vascular disease
  - Congestive heart failure
  - Severity and duration of angina
- Therapeutic history
  - Digitalis
  - Quinidine
  - Antihypertensive drugs
  - Diuretics
  - Anticoagulants and control
- Symptoms, signs, and clinical factors
  - Premonitory symptoms
  - Diaphoresis
  - Presence, duration, and severity of pain before, during, and after admission
  - Blood pressure before and after admission
  - Maximum and minimum heart rates
  - Highest temperature and duration of temperature elevation (in degrees Fahrenheit)
  - Left- and right-sided heart failure
  - Venous pressure
  - Quality of heart tones
  - Murmurs, rub, and gallop rhythm
  - Heart size
- Laboratory data
  - White blood cell count
  - Differential count
  - Erythrocyte sedimentation rate
  - Serum glutamic oxaloacetic acid transaminase
  - Lactic acid dehydrogenase
  - Acute electrocardiographic changes
  - Chronic electrocardiographic changes
  - Arrhythmias on electrocardiogram
  - Conduction defects on electrocardiogram
- Hospital course
  - Use of digitalis
  - Use of quinidine
  - Digitalis toxicity
  - Use of anticoagulants and type
  - Anticoagulation control
  - Length of bed rest
  - Extension of infarction
  - Embolism
  - Length of survival
  - Autopsy

TABLE II. Subdivision of selected factors*

- Age
  - Under 25
  - 25 to 34
  - 35 to 39
  - 40 to 49
  - 50 to 59
  - 60 to 69
  - 70 to 79
  - 80 or over
- Duration of pain (hours) before admission
  - Under 1/3
  - 2 1/3 to 6
  - 7 to 24
  - 24 to 48
  - Over 48
  - Intermittent
  - No pain
- Left-sided heart failure
  - None
  - Plus to minus
  - Slight
  - Moderate
  - Severe
- Acute electrocardiographic changes
  - Within normal limits
  - Nonspecific
  - Anteroseptal infarction
  - Anterior infarction
  - Anterolateral infarction
  - Posterior infarction
  - Posterolateral infarction
  - Apical infarction
  - Diaphragmatic infarction

* Each subdivision is exactly described in the general protocol. There are provisions for no data being available for a given factor in the patient's history.

ately active," "active," and "very active" (Table II). Since this was a retrospective study, the selection of the factors and their subdivision was guided by the actual content of the medical charts. In an anterospective study, the study governs the collection of the data, and restriction to data already in the charts is circumvented.

CODING OF CLINICAL INFORMATION. Based on the factors selected and their subdivisions, three code sheets designated A, B, and C were designed. Code sheet A contained the first 23 factors in the study (Fig. 1), code sheet B the next 23, and code sheet C the remaining 22. These code sheets were in a format designed to make data transcription from the hospital chart accurate and rapid.

Mark sensing of punch cards was the technic employed. Mark sensing is based on the principle that a mark made by a special pencil can conduct electricity. Three mark-sensed cards A (Fig. 2), B, and C were designed. The 68 factors under consideration were then transcribed from hospital charts to the mark-sensed cards by making pencil marks in the appropriate positions. To facilitate transcription further, the sequential order of the factors on the mark-sensed cards followed closely the order in which the information appeared on the chart, thus decreasing the necessity of thumbing back and forth through the charts. A mark-sensing device then read the pencil marks on the cards and punched

Case Number								
Card Number								
Age of Patient	–25	25–34	35–39	40–49	50–59	60–69	70–79	80–
Sex of Patient	Male	Female						
Occupation & Physic. Activity	Sedent.	Mod. Act.	A tive	Very Act.				
Previous Myocardial Infarctions	0	1	2	3	4	5 or more		
Body Weight	Under Weight	NL	Over Weight	Greatly Ov. Wgt.				
Smoking	Cigars	Pipe	Cigarettes –15	Cigarettes 16–30	Cigarettes 31–	Non Smoker		
Diabetes Mellitus	Absent	Mild	Moderate	Severe				
Diabetic Control	Poor Control	Well Controlled						
Pulmonary Disease	Absent	Mild	Moderate	Severe				
Hypertension	Absent	Mild	Moderate	Severe				
Vascular CNS Dis.	Absent	Mild	Moderate	Severe				
Art. Periph. Vasc. Disease	Absent	Mild	Moderate	Severe				
Ven. Periph. Vasc. Disease	Absent	Mild	Moderate	Severe				
Con. Heart Fail.	Absent	Mild	Moderate	Severe				
Angina	Absent	Mild	Moderate	Severe				
Duration of Angina	–1 Mo.	1 Mo–1 Yr	1 Yr–5Yr	5 Yr–10 Yr	10–			

FIGURE 1. Coding sheet A, showing 18 of the first 23 factors.

the corresponding holes in the same cards. The average time for transcribing one chart was 22.5 minutes; one hundred thirty-eight hours were required to transcribe the 368 cases.

COMPUTER TECHNICS. The three mark-sensed cards, A, B, and C were then merged into a single standard IBM card with the aid of an IBM 1401 data-processing system. These standard IBM cards were the basic data source for all further procedures. The data from these cards were then tabulated and those factors with insufficient data density were excluded from present consideration. Of the initial 68 factors, 8 were found to have insufficient data and were not considered further in this study. The remaining 60 factors were cross-tabulated with an IBM 7090 data-processing system, yielding some 1,800 tables. some relating two factors and some relating three and four. These tables were used to define their frequency distributions (Table III), to construct histograms, and, using chi-square technics, to study their independence. Various significance tests such as the Z-test were used to study the distributions. The results of

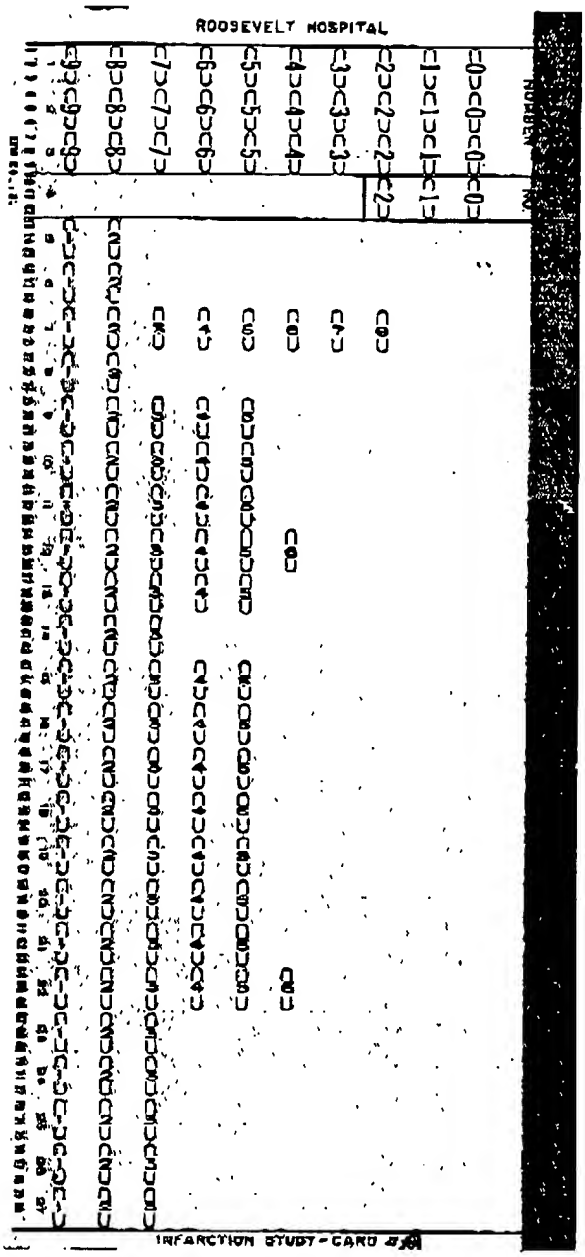

FIGURE 2. Mark-sensed card A, containing the first 23 factors corresponding to coding sheet A (Fig. 1).

these procedures were used as a basis for decisions as to further processing. In the area of parametric statistics, we decided to use regression analysis and factor analysis. For nonparametric methods, we selected cluster analysis for processing of these data. The operational flow sheet represents the over-all design of the study and illustrates the various steps in sequence (Fig. 3). We may note that at several points in this sequence, choices as to further processing can be made. This permits sufficient flexibility in the over-all system design.

Regression analysis and results

On the basis of the cross-tabulation results, the method of regression analysis was decided on. The immediate prognosis of the patient was the first subject of investigation by regression analysis. Survival for the length of the hospital stay of a patient with myocardial infarction was assumed to be a linear function of nine independent variables selected on a clinical basis. The following mathematical model was used:

$$X(10) = \sum_{i=1}^{i=9} a_i X(i) + K$$

where:

- $X(10)$ = survival
- $X(1)$ = blood pressure on admission
- $X(2)$ = blood pressure after admission
- $X(3)$ = age of patient
- $X(4)$ = number of previous myocardial infarctions
- $X(5)$ = highest cardiac rate
- $X(6)$ = highest temperature (in degrees Fahrenheit)
- $X(7)$ = duration of hyperpyrexia
- $X(8)$ = left heart failure
- $X(9)$ = right heart failure

These variables were transformed nonlinearly into a new set of variables, assuming values of from 0.000 to 1.000. The following equation was generated by using a stepwise regression program for the IBM 7090 system:

$$X(10) = -0.4587(X)2 - 0.1899X(4) - 0.1524(X)8 + 0.1154(X)7 - 0.1141X(8) - 0.0787\,X(5) + 0.0622(X)1 + 0.0440\,X(9) + 0.0277\,X(6) + 1.1339$$

This equation and other initial results with regression analysis indicate that of the nine independent variables used, the presence of clinical shock had the highest negative correlation with survival, the regression coefficient being −0.4587. There was a considerable decrease in significance between clinical shock and the next most important factor, previous myocardial infarctions, which had a regression coefficient of −0.1899. The factors after that in descending order were age, duration of

TABLE III. Frequency of occurrence f selected clinical and laboratory characteristics

Clinical or Laboratory Characteristic*	Percentage of Total Cases or of Cases With Condition		Clinical or Laboratory Characteristic*	Percentage of Total Cases or of Cases With Condition	
Previous myocardial infarctions			No electrocardiogram (early death)		3.7
None		76.0			
One		16.6	Chronic electrocardiographic changes		
Two		7.4	Abnormal		53.1
Diabetes		10.5	Nonspecific changes	38.2	
Hypertension, total		29.0	Specific changes suggesting previous infarctions	14.9	
Mild	6.4				
Moderate	18.1		Arrhythmias, total		23.4
Severe	4.5		Premature contractions, frequent		
Arterial vascular disease		11.2	Atrial		1.6
Angina			Ventricular		4.9
Incidence		44.2	Atrial and ventricular		1.1
Duration less than one year		52.8	Sinus bradycardia		9.5
Pain			Sinus tachycardia		19.0
Incidence		80.0	Nodal rhythm		3.2
Mild		7.8	Supraventricular tachycardia		0.8
Moderate		36.7	Atrial flutter		5.4
Severe		54.2	Ventricular tachycardia		0.8
Shock		17.2	Ventricular fibrillation		0.3
Hypotension without shock		10.6			
Temperature			Conduction defects, total		21.2
Over 102 F.		8.5	Atrioventricular block		
Under 99 F.		18.6	First degree	4.1	
Heart failure, moderate to severe			Second degree	2.4	
Left side		31.4	Third degree	2.2	
Right side		17.6	All degrees	8.7	
Gallop rhythm		8.9	Bundle branch block		
Extension of infarct		8.0	Complete left	1.6	
Erythrocyte sedimentation rate over 20 mm. per hour		78.7	Incomplete left	1.1	
Serum glutamic oxaloacetic transaminase elevated		70.0	Complete right	5.2	
Acute electrocardiographic changes			Incomplete right	0.8	
No changes		0.3	Intraventricular block	3.8	
Nonspecific changes		5.4			
Anterior myocardial infarction		53.0	Anticoagulation		68.0
Posterior myocardial infarction		24.3	Embolism		4.1
Apical and diaphragmatic myocardial infarction		13.3	Over-all mortality		18.5
			Autopsy rate		33.9

* The mean age of males was 60.4 years and of females, 67.0 years. The sex ratio was 2.9 males to 1 female.

temperature, left heart failure, tachycardia, blood pressure on admission, highest temperature, and right heart failure. Further work in this area included use of different sets of dependent and independent variables, higher order regressions, and nonlinear regression equations, as well as nonlinear transformations on the independent variables. Thus, interdependence of the various subsets of factors can be studied in depth. Peel *et al.*[4] utilized a different mathematical approach to study this problem.

Factor analysis, using various subsets of variables and several modifications, was used to search for basic underlying physiologic factors that may account for the clinical variables recorded. The mathematical model used was

$$Z_j = \sum_{p=1}^{p=N} A_{jp} F_p$$

where Z_j is the jth variable, F_p is the p^{th} common factor, and A_{jp} is the factor coefficient.

Five factors were used in the initial effort. Considering the same 10 variables as in regression analysis, these five factors accounted for 99.9 per cent of the variance.

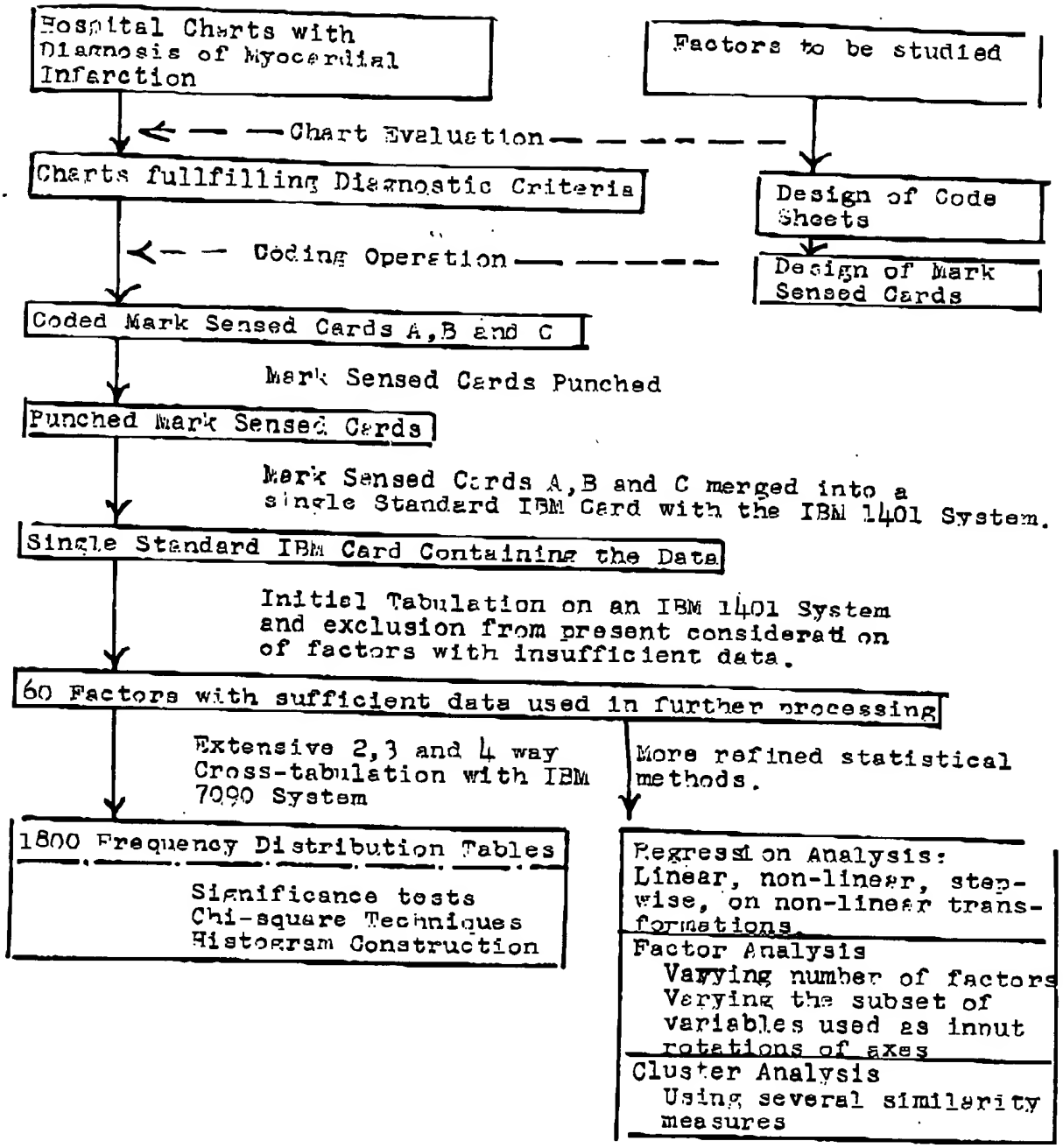

FIGURE 3. Operational flow sheet.

This phase of the work, as well as the regression analysis, is still in progress, since various modifications are being attempted to describe the clinical situation most accurately.

Cluster analysis and results

Cluster analysis is another approach to the study of clinical problems. It is basically a method for sorting individuals into groups according to a set of characteristics. Groups assembled by this procedure consist of individuals who are mutually similar and dissimilar to individuals placed in other groups. The advantage of this technic is that no assumptions need be made about the basic distribution, such as the normality of the sample. While this work is still in its initial phases, we expect that the successful

TABLE IV. Sex versus age versus survival

Age	Number of Males	Per Cent of Males	Number of Females	Per Cent of Females	Male-Female Survival Ratio
Less than 50	38/40	95.0	4/4	100.0	0.95
50 to 59	83/99	83.1	22/22	100.0	0.83
60 to 69	68/86	79.0	21/30	70.0	1.13
70 to 79	30/40	75.0	20/26	77.0	0.97
80 or more	5/9	56.0	7/12	58.0	0.97
Totals	224/274	81.7	74/94	78.5	1.04

adoption of this technic will open new areas of investigation in the statistical analysis of clinical diagnosis.

General Results

Because of the large amount of data studied and the detailed analysis performed, it will not be possible to discuss all the results in this report. However, a sampling of the total results obtained from this study follows:

1. Our group of patients approximates a simple random sample of the population of all patients admitted to the hospital with myocardial infarction in our locale.

2. The tabulated results in this study fall within the ranges given in other studies of this disease.[6-10]

3. Use of cross tabulations shows that age distribution in both male and female can be represented by a skewed normal distribution curve, with the mean age for females being 6.6 years more than for males (67 years for females and 60.4 years for males).

4. Regression analysis and cross tabulation bear out the grave prognosis represented by clinical shock in a patient with myocardial infarction. Of those without shock, 91.5 per cent survived, while only 31.8 per cent of patients with clinical shock survived.

5. Three-way cross tabulation of age versus sex versus survival indicates that there is no great difference in survival between males and females at any age level (Table IV).

6. History of previous myocardial infarctions, advanced age, duration of temperature elevation, failure of the left side of the heart, and tachycardia are clinical factors that carry a grave prognosis.

Summary

A computer-supported clinical study concerning the natural history and prognosis of myocardial infarction was carried out. The use of an automated data-processing system facilitated the collection of clinical data and permitted the use of advanced statistical procedures in the evaluation of these data. Clinical shock was found to be the most important factor in the prognosis of this disease. Other important clinical and laboratory features of this disease were investigated statistically.

Further studies concerning the application of computer systems and technics to clinical heart disease are in progress and will be reported on in the future.

535 West 110th Street

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10/1

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10/2020

Please provide a copy of the following:

1) Chapelle (Acta Clinica Belgica, 39(6):393-395 (1984)).

Thanks a bunch!
Gail

7368701

6534044

HOW SHOULD WE PROCEED WHEN A MYOCARDIAL INFARCTION IS SUSPECTED

J.P. Chapelle*

In the diagnosis of acute myocardial infarction (MI), increasing reliance is being placed on assays of tissue markers; such tests are commonly believed to provide unequivocal diagnostic information (1). The discrimination between patients with and without MI can however be further improved by an appropriate selection of laboratory investigations. The purpose of this note — which restricts to the biochemical assessment of MI — is to answer the following questions :

— which are the best tests for identifying MI patients ?
— does the combination of two or several tests improve the diagnostic performance of the tests taken separately ?
— when and how frequently must the measurements be performed to achieve optimal diagnostic efficiency ?

Tissue markers for MI should satisfy the following criteria :

1. large differences between serum concentrations after MI and normal levels;
2. earliness of the rise and persistance of elevated levels;
3. stability;
4. myocardium specificity;
5. analytical characteristics (sensitivity, specificity, cost, practicability,...).

Furthermore, the chronology of the changes observed in the serum concentrations of the myocardium constituents after MI should also be accounted for. Therefore, we consider that the most efficient diagnostic tests in cases of suspected MI are : 1) myoglobin, 2) CK-MB, the MB isoenzyme of creatine kinase and, 3) LD-1, the myocardium specific isoenzyme of lactate dehydrogenase, which tends to replace the determination of the ratio between LD-1 and LD-2 (LD-1/LD-2).

Serum myoglobin concentration rises within the first few hours after the onset of symptoms of acute MI and maximum levels are reached, on average, 10 to 14 hrs earlier than CK-MB peak activity; in most cases, levels return to normal within 32 to 40 hrs. Myoglobin assay suffers from a lack of specificity but, in terms of sensitivity, its superiority over CK-MB and LD is well established, particularly when blood is taken within a short time following the attack (2). Hence, the major interest of myoglobin is the high predictive value of a negative test result ($< 80\ \mu g/l$), which allows to identify non-MI patients with a high probability. New commercially available agglutination tests now provide within a few minutes a semi-quantitative estimation of myoglobin, whence taking full advantage of the early rise of this constituent (3).

Using the most sensitive assays, for example immunoenzymetric methods (4), CK-MB can be detected from about 4 to 60 hrs following

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MI, peak levels being recorded after 18 to 24 hrs. Among the routinely used laboratory tests, CK-MB is undoubtedly the most specific test for diagnosing MI, because its concentrations are much more important in myocardium (20 % of total CK) than in other tissues (1 % of total CK) (5). Recently however attention has been given to marathon runners, who exhibit, both during training for and after a marathon race, serum CK-MB percentages in the range suggestive of MI (6).

After MI, LD slowly increases in the blood and reaches its peak level 36 to 40 hrs after the onset of symptons of acute MI, returning to reference levels 6 to 10 days later. A « flipped » LD-1/LD-2 ratio (> 0.7-1.0, depending on analytical methods) or increased LD-1 percentages (> 40 % of total LD) are indicative of myocardial damage (7). False negative results occur however during the first 24 hrs following MI, particularly in patients with small infarcts (8). Hence, this test must be performed during the second or third day following the onset of chest pain, and is particularly appropriate in patients with delayed hospitalization.

When added to a combination of these three tests (for example CK-MB - LD-1), all other biochemical constituents classically used for diagnosing MI (total CK, aspartate aminotransferase, α -hydroxybutyrate dehydrogenase,...) do not significantly improve the diagnostic efficiency; the specificity of CK-MB or LD-1, for example, is so good that doing more tests gains little. It has also been demonstrated that the sensitivity of a single indicator may be considerably improved when determinations are repeated, for example when the results from the second hospitalization day are added to those of the first (9).

Consequently, to maximize the effectiveness of laboratory tests used in the diagnosis of MI and to minimize costs, we recommend to use combinations of two tests; the strategy (selected tests and frequency of determinations) used to obtain maximum information depends however on the time elapsed between the onset of symptoms and the first blood sampling.

In patients with suspected MI hospitalized within 12 hrs after the attack, myoglobin and CK-MB must be measured as soon as possible (hospital admission), and assays be repeated 4 and 8 hrs later; negative results obtained for the two tests on the three samples almost rule out myocardial necrosis, but a final confirmation, based on CK-MB, may be done 12 or 24 hrs later. Elevated myoglobin concentrations combined with CK-MB levels increasing with time are, on the contrary, indicative of MI. When delays in hospitalization exceed 12 to 24 hrs, myoglobin is useless. Diagnosis must be based on CK-MB and LD-1 (or LD-1/LD-2 ratio) determinations performed on admission and 12 or 24 hrs later.

In conclusion :

1. myoglobin, CK-MB and LD-1 (or LD-1/LD-2 ratio) are the most appropriate tests in cases of suspected MI;
2. the combinations of myglobin and CK-MB in the acute phase, or CK-MB and LD-1 for late admission improves the sensitivity of each test taken separately;
3. the diagnostic efficiency is further improved by three consecutive determinations (acute phase) or determinations repeated on two consecutive days (more than 24 hrs).

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